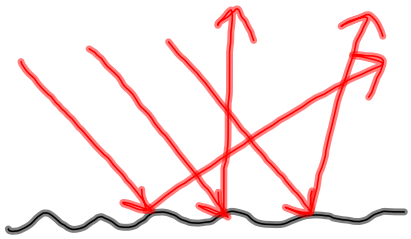
- Refraction:
  - When light goes from a lower n to a higher n, the light bends towards the normal.
  - When light goes from a higher n to a lower n, the light bends away from the normal.

- Reflection:
  - Diffuse

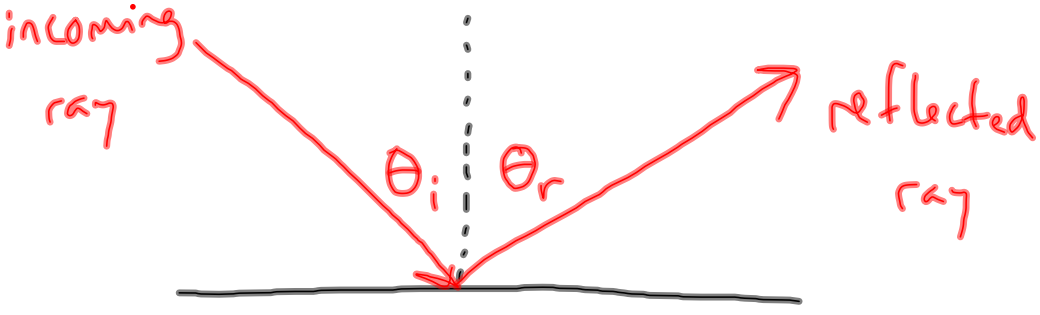


reflected light is not coherent, so no image is formed

  - Spectral

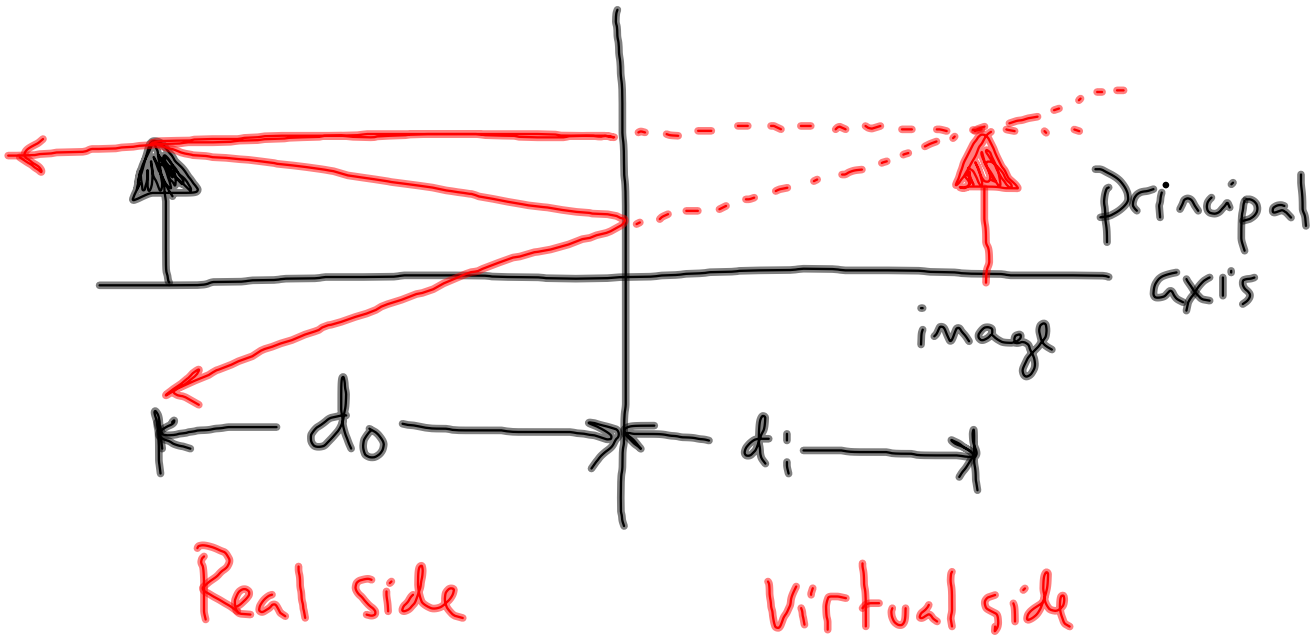
reflected light is coherent, so image will be formed

- angle of reflection:



$$\theta_i = \theta_r$$

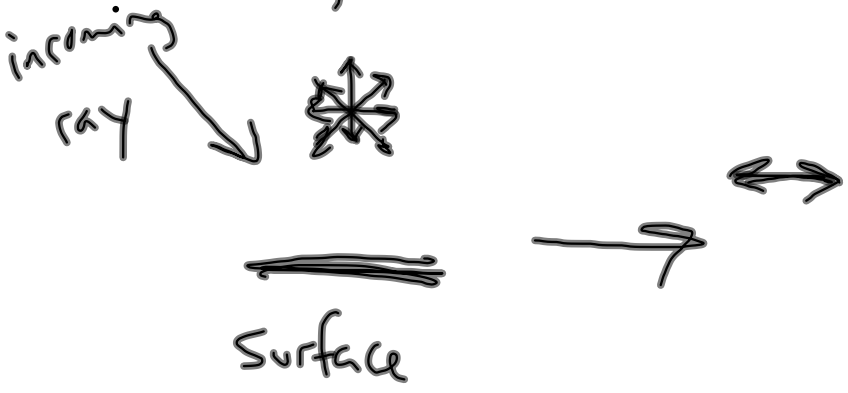
- Flat mirrors:



d_o → object distance d_i → image distance

- for a flat mirror, $d_o = d_i$
- where rays intersect is called the image
- Image can either be real or virtual

- Polarization:
  - Polarization is the way the light is aligned.
  - "Normal" light 
  - When light hits a reflective surface, the polarization is aligned with the surface.



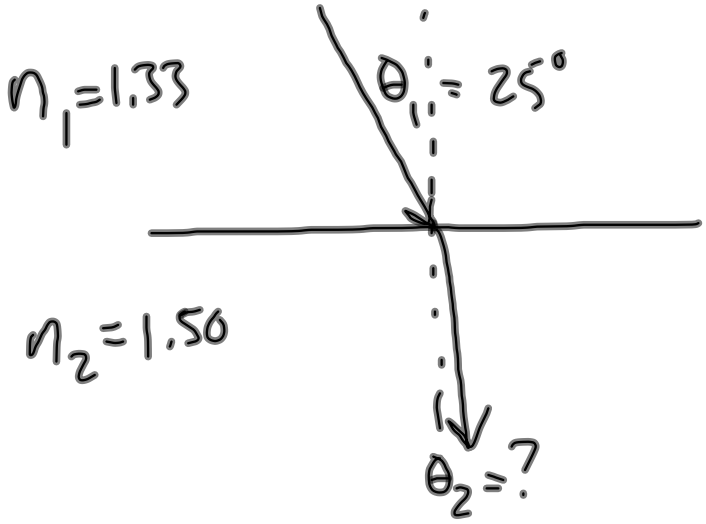
What is the length of an open/open pipe in which the fifth harmonic has a frequency of 3840 Hz? The speed of sound is 346 m/s.

$$f_n = \frac{nv}{2L}$$

$$L = \frac{nv}{2f_n} \qquad n = 5$$

$$= 0.225 \text{ m}$$

A light ray travels through water (n = 1.33) and enters glass (n = 1.50). If the incoming angle is equal to 25 degrees, what is the angle that the light makes with the normal when it enters the glass?



$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$\sin\theta_2 = \frac{n_1}{n_2} \sin\theta_1$$

$$\theta_2 = \sin^{-1}\left(\frac{n_1}{n_2} \sin\theta_1\right)$$

$$= 22°$$